6. MR. H. S. GROPP
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WORLD TRADE CENTER

EXTERIOR WALL, SPANDRELS AND EXTERIOR COLUMN INSULATIONS

THERMAL CONDUCTIVITY AND HEAT TRANSMISSION COEFFICIENTS

Value Based on Wall & Column Design As of 5/5/66
Drawing A-A-314

Fireproofing Material	Conductivity (k) BTU / HR-SF-8F-IN	"U" - Coefficient Transmission - BTU/HR-SF-OF				
		At Sides of Column		At Outside Face of Column (W/Air Space)		
		With 1 5/8" F. P.& Air Space	1 5/8" F. P.+ 3/8" Urethane No Air Space	With 1 5/8" F. P.	1 5/8" F. P.+ 3/8" Urethane	With 2" F.P. and 3/8" Polyurethane
1. Sprayed Mineral Fiber (Spraycraft)	.26	0.135	0.116	.136	.104	.092
2. Sprayed (Cementitious) Vermiculite (Monokote)	.75	0.302	.221	.302	.182	0.167
3. Laminated Gypsum Board (U.S.G. FireCode)	1.11	0.385	.261	.385	.209	.195
4. Concrete (L.W. 100 PCF)	3.57	0.630	.353	.625	.264	.256
5. Vonco	.38	0.185	.151	.185	.131	0.116
6. Cafco	.27	0.140	.119	.140	0.107	0.093

Notes:
1. Fireproofing for inside face of column is assumed to be 1 3/8" gupsum plaster having conductivity of 1.56 and the overall transmission coeff. of .396 between the room and column steel.
2. Inside still air film resistance is taken as .68
3. Outside air film resistance is taken as .17
4. Air space resistance is taken as .97

PLAINTIFF'S EXHIBIT PX 450

WTCI-457-P

WORLD TRADE CENTER

EXTERIOR WALL, SPANDRELS AND EXTERIOR COLUMN INSULATIONS

THERMAL CONDUCTIVITY AND HEAT TRANSMISSION COEFFICIENTS

Value Based on Wall & Column Design As of 5/5/66
Drawing A-A-314

Fireproofing Material	Conductivity (k) BTU HR-SF-°F-IN	"U" - Coefficient Transmission - BTU/HR-SF-°F At Sides of Column		At Outside Face of Column (w/Air Space)		
		With 1 5/8" F.P.	With 3/8" Polyurethane Included	With 1 5/8" F.P.	F.P. With 3/8" Polyurethane Included	With 2" F.P. and 3/8" Polyurethane
1. Sprayed Mineral Fiber (Spraycraft)	.26	0.135	0.116	.136	.104	.092
2. Sprayed (Cementitious) Vermiculite (Monokote)	.75	0.302	.221	.302	.182	0.167
3. Laminated Gypsum Board (U. S. G. Fire Code)	1.11	0.385	.261	.385	.209	.195
4. Concrete (L.W. 100 PCF	3.57	0.630	.353	.625	.264	.256
5. Vermi	.38	0.185	.151	.185	.131	0.116
6. Cafco	.27	0.140	.119	.140	0.107	0.093

Notes:

1. Fireproofing for inside face of column is assumed to be 1 3/8" gypsum plaster having conductivity of 1.56 and the overall transmission coeff. of .396 between the room and column steel.
2. Inside still air film resistance is taken as .68
3. Outside air film resistance is taken as .17
4. Air space resistance is taken as .97
5. Conductivity of polyurethane is taken as .17

NC:rt,dd

PRELIMINARY STUDY

WTC - EXTERIOR WALL INSULATIONS

SPANDRELS AND EXTERIOR COLUMNS

THERMAL CONDUCTIVITY AND HEAT TRANSMISSION COEFFICIENTS
~~(In Order of Max. Thermal Reduction)~~

VALUES BASED ON WALL & COLUMN DESIGN
As of May 5, 1966

	MATERIAL	CONDUCTIVITY (k) BTU/HR-SF-°F-IN ~~(Resistivity) "K"~~	RESISTANCE (R) HR-SF-°F-IN BTU ~~(Conductance) "C"~~	"U" - COEFF. TRANSMISSION - BTU/HR-SF-°F ~~Thermal Reduction Value~~ At Sides of Column: With 1-5/8" F.P.	At Sides of Column: With 3/8" Polyurethane Included	At Outside Face of Column (w/Air Space): With 1-5/8" F.P.	At Outside Face of Column (w/Air Space): With 3/8" Polyurethane Incl.	At Outside Face of Column (w/Air Space): With 2" F.P. and 3/8" Polyurethane
1.	Sprayed Mineral Fibre (Spraycraft) ~~or Gafcot~~	~~0.04~~ .26	~~0.24~~ 3.85	~~0.29~~ .141	~~0.20~~ .102	~~0.19~~ .124	~~0.16~~ .097	~~0.14~~ .086
2.	Sprayed (Cementitious) Vermiculite (Monokote)	~~0.08~~ .25	~~0.96~~ 1.32	~~0.37~~ .332	~~0.20~~ .192	~~0.24~~ .125	~~0.20~~ .162	~~0.18~~ .138
3.	Laminated Gypsum Board (U. S. G. Fire Code)	~~0.15~~ 1.11	~~0.90~~ .9	~~0.79~~ .433	~~0.39~~ .222	~~0.46~~ .305	~~0.27~~ .183	~~0.25~~ .172
4.	Concrete (L.W. 100 PCF)	~~0.30~~ 3.57	~~1.80~~ .28	~~1.37~~ .767	~~0.41~~ .285	~~0.53~~ .44	~~0.30~~ .224	~~0.28~~ .218
5.	Gypsum Plaster	~~0.50~~ 1.56	~~2.00~~ 1.64	2.05	0.53 1 1/8"	0.60	0.32	0.31
5		.39	2.	.195	.137	.164	.12	.108
6		.27	3.7	.146	.11	.128	.097	.088

1 1/8" Plaster finish U = .312

Definition of U and physical arrangement used Clarification.

1962-64

WTC - EXTERIOR WALL INSULATION

SPANDRELS AND EXTERIOR COLUMNS

THERMAL CONDUCTIVITY AND HEAT TRANSMISSION
(In Order of Max. Thermal Reduction)

would be of transmission coefficient?

VALUES BASED ON WALL & COLUMN DESIGN
As of May 5, 1966
(DRAWING A-P-303)

MATERIAL	K (Resistivity) "K"	C (Conductance) "C"	"U" - Thermal Reduction Value				
			At Sides of Column		At Outside Face of Column (w/Air Space)		
			With 1-5/8" F.P.	With 3/8" Polyurethane Included	With 1-5/8" F.P.	With 3/8" Polyurethane Incl.	With 2" F.P. and 3/8" Polyurethane
Sprayed Mineral Fibre (Spraycraft or Cafco)	0.04	0.24	0.23	0.20	0.19	0.16	0.14
Sprayed (Cementitious) Vermiculite (Monokote)	0.06	0.36	0.34	0.26	0.24	0.20	0.18
Laminated Gypsum Board (U. S. G. Fire Code)	0.15	0.90	0.79	0.39	0.46	0.27	0.25
Concrete (L.W. 100 PCF)	0.30	1.80	1.37	0.41	0.53	0.30	0.29
Gypsum Plaster	0.50	3.00	2.05	0.51	0.60	0.32	0.31

Source of these values and their clear definition is important

"U" IS FIGURED TO STEEL COLUMN.

REVISED

REVISED JUNE 23, 1966

192-67

WORLD TRADE CENTER

EXTERIOR WALL, SPANDRELS AND EXTERIOR COLUMN INSULATIONS

WITH 1 5/8" F.P. & AIR SPACE

THERMAL CONDUCTIVITY AND HEAT TRANSMISSION COEFFICIENTS

Value Based on Wall & Column Design Shown on SK M-A-72 (June 23, 1966)

Fireproofing Material	Conductivity (k) BTU / HR-SF-PER-IN.	R	"U" - Coefficient Transmission - BTU/HR-SF-°F At Sides of Column: With 1 5/8" F.P.	At Sides of Column: With 3/8" Polyurethane Included	At Outside Face of Column (W/Air Space): With 1 5/8" F.P.	At Outside Face of Column (W/Air Space): With 3/8" Polyurethane Included	At Outside Face of Column (W/Air Space): With 2" F.P. and 3/8" Polyurethane
1. Sprayed Mineral Fiber (Spraycraft)	.26	3.85	.135 ~~.151~~	.116 ~~.129~~	.136	.104	.092
2. Sprayed (Cementitious) Vermiculite (Monokote)	.75	1.335	.302 ~~.429~~	.221	.302	.182	.152
3. Laminated Gypsum Board (U. S. G. Fire Code)	1.11	.9	.345 ~~.595~~	.261	.385	.209	.195
4. Concrete (L.W. 100 PCF)	3.57	.28	.63 ~~1.62~~	.353	.625	.264	.256
5. Vonco	.38	2.63	~~.225~~	.151	.185	.131	.127
6. Cafco	.27	3.7	.14 ~~.162~~	.119	.140	.106	.094

Notes:

1. Fireproofing for inside face of column is assumed to be 1 3/8" gypsum plaster having conductivity of 1.56 and the overall transmission coeff. of .396 between the room and column steel.
2. Inside still air film resistance is taken as .68
3. Outside air film resistance is taken as .17
4. Air space resistance is taken as .97
5. Conductivity of polyurethane is taken as .17

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